**Ultrasonic synthesis of CeO2@organic dye nanohybrid: environmentally benign rabid electrochemical sensing platform for carcinogenic pollutant in water samples**


ABSTRACT

A novel organic-inorganic nile-blue - CeO2 (CeO2/NB) nanohybrid has been synthesized by environmentally benign ultrasonic irradiation method for the selective determination of the environmental pollutant, carcinogenic hydrazine (HZ) in environmental water samples. Hydrophobic dyes have generally been as redox mediators in electrochemical sensors fabrication due to strong electron transfer capacity and they would allow the oxidation and reduction of the analytes at lower potentials. The CeO2 nanoparticles were initially synthesized by the ultrasonic irradiation of Ce(NO3)2, NH4OH and ethylene glycol mixture for 6 h using probe sonicator (20 kHz, 100 W) followed by calcination. The organic-dye NB was then added and ultrasonicated further 30 min for the formation of CeO2/NB nanohybrid material. Various spectroscopic and microscopic tools such as UV–vis and FT-IR spectroscopy, XRD, SEM and high-solution TEM and surface analysis tool Brunauer-Emmett-Teller (BET) confirm the formation of the nanohybrid. HR-TEM images showed the well-covered CeO2 on NB molecules and the average size of the nanohybrid is ~35 nm. For the fabrication of environmental pollutant electrochemical sensor, the prepared CeO2/NB nanohybrid was drop-casted on the electrode surface and utilized for the determination of HZ. The nanohybrid modified electrode exhibits higher electrocatalytic activity by showing enhanced oxidation current and less positive potential shift towards HZ oxidation than the bare and individual CeO2 and NB modified electrodes. The fabricated sensor with excellent reproducibility, repeatability, long-term storage stability and cyclic stability exhibited the sensational sensitivity (484.86 μA mM−1 cm−2) and specificity in the presence of 50-fold possible interfering agents with the lowest limit of detection of 57 nM (S/N = 3) against HZ. Utilization of the present sensor in environmental samples with excellent recovery proves it practicability in the determination of HZ in real-time application.



**Keyword:** CeO2/nile-blue nanohybrid; Carcinogenic hydrazine; Ultrasonic-irradiation; Cyclic stability; Environmental samples; Electrocatalytic activity